

## **REMARKS**

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 11-13, 17-19, 23-25, and 31-34 are requested to be cancelled.

This amendment adds, changes and/or deletes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-10, 14-16, 20-22, and 28-30 are now pending in this application.

### **Rejections under 35 U.S.C. § 112**

Claims 1-25 and 28-34 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the written description requirement. Claims 8-25 and 28-33 are rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite. These rejections are respectfully traversed. Applicant respectfully submits that the amendments to the claims render these rejections moot.

In addition, Applicant respectfully submits that the disclosure of Applicant's application provides support for the amendments to the claims. For example, Figure 2 shows an example of a first thermoelectric converter element 10 and a second thermoelectric converter element 20. Joint member d13, d23 provide examples of joining members in Figure 2. Elements A11, A21 in Figure 2 are examples of first electric conductor members and elements B12, B22 are examples of second electric conductor members. As shown in the example of Figure 2, a side of the first electric conduction member A11 of the first thermoelectric converter element 10 opposite to a side of the joint member d13 of the first thermoelectric converter element 10 is electrically connected via a direct current source  $V_{ex}$  and an electric conduction material d14, 15 to a side of the first electric conductor member A21 of the second thermoelectric converter element 20 that is opposite to the joint member

d23 of the second thermoelectric converter element 20. Furthermore, the example shown in Figure 2 shows a side of the second electric conductor member B12 that is opposite to the joint member d13 of the first thermoelectric converter element 10 that is electrically connected via another electric conduction material d14, d15 to a side of the second electric conductor member B22 of the second thermoelectric converter element 20. Applicant's specification also provides support, such as on page 10, line 24, to page 11, line 3.

In regard to the claimed thermoelectric effect devices and energy conversion systems, Applicant notes that the energy conversion systems include thermoelectric effect devices. In a thermoelectric effect device in which a direct current source is connected in-line via the electric conduction material to first and second thermoelectric converter elements constituting a Peltier effect heat transfer circuit system, a distance is provided between the endothermic section and the exothermic section such that a temperature  $T_{\alpha}$  at the endothermic section and a temperature  $T_{\beta}$  at the exothermic section maintain a relation  $T_{\alpha} < T_{\beta}$ , as recited, for example, in claim 1.

In contrast, an energy conversion system the first thermoelectric converter element and the second thermoelectric converter element are disposed in ambient temperatures different from one another, and wherein the energy direct conversion system is configured such that an ambient temperature  $T_1$  of one of the thermoelectric converter elements on a high temperature side and an ambient temperature  $T_2$  of the other of thermoelectric converter elements on a low temperature side maintain a relation  $T_1 > T_2$ , wherein the energy direct conversion system is configured to take out an electric potential energy from a predetermined section of the electric conduction materials to constitute a direct energy conversion electric circuit system to directly convert a heat energy into the electric potential energy, as recited, for example, in claim 3. In addition, the energy conversion system can be structured such that the thermoelectric effect device is provided and heat energy obtained from the thermoelectric device is supplied to the energy conversion system to obtain electrical potential energy, with a part of the electric potential energy used as a direct current source of the energy conversion system by feeding back part of the electric potential energy to the thermoelectric effect device.

Figures 8-13 of Applicant's disclosure provide examples of an energy conversion system using a thermoelectric effect device.

In addition, at least page 9, line 27, to page 10, line 19; page 14, lines 21-29; and page 15, lines 27-31, of Applicant's specification provide support for the feature of each electric conduction material having such a length as to keep the first thermoelectric converter element and the second thermoelectric converter element at least free from a mutual thermal interference.

For at least the reasons discussed above, reconsideration and withdrawal of these rejections is respectfully requested.

**Rejection Under 35 U.S.C. §102**

Claims 1-4 and 34 are rejected under 35 U.S.C. §102(b) as allegedly being anticipated by U.S. Patent 5,006,178 to Bijvoets (hereafter "Bijvoets"). Applicant respectfully traverses this rejection for at least the reasons set forth below.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). See generally MPEP § 2131.

Bijvoets discloses a thermoelectric device that includes plates 2 and 3, bridges 5, and thermoelectric elements 4 formed by element halves 6, 7, with an element half 6 including two P conductivity type semiconducting pieces 8 and an intermediate piece 9, and with an element half 7 including two N conductivity type semiconducting pieces 10 and an intermediate piece 9. See col. 2, line 52, to col. 3, line 3, of Bijvoets. The thermoelectric elements 4 are connected by bridges 5. See col. 2, lines 54-55, of Bijvoets. Bijvoets also discloses that the semiconducting pieces 8, 10 can be made of BiTe and that the intermediate pieces 9 can be made of copper. See col. 4, lines 24-26, and col. 5, lines 7-21, of Bijvoets.

On page 5 of the Office Action the Office identifies the semiconducting pieces 8, 10 as first and second electric conductor members, plates 2, 3 and bridges 5 as joint members, and the intermediate pieces 9 of Bijvoets as electric conduction material.

However, Bijvoets fails to disclose a thermoelectric effect device, wherein the thermoelectric effect device is configured such that a side of a first electric conductor member of a first thermoelectric converter element that is opposite to a joint member of the first thermoelectric converter element is electrically connected via an electric conduction material and a direct current source to a side of a first electric conductor member of a second thermoelectric converter element that is opposite to the joint member of the second thermoelectric converter element, as recited in claims 1 and 2. Claims 3 and 4 include the features of claims 1 and 2, respectively.

As shown in the Figure of Bijvoets, Bijvoets does not disclose or suggest a direct current source electrically connected to first electric conductor members via electric conduction material. The Figure of Bijvoets does not show a direct current source electrically connected between the semiconducting pieces 8 or 10 via the intermediate pieces 9.

In addition, the device of Bijvoets is not arranged such that each electric conduction material has such a length as to keep a first thermoelectric converter element and a second thermoelectric converter element at least free from a mutual thermal interference, as recited in claims 1 and 2. An object of the device of Bijvoets is to reduce the quantity of the semiconductor pieces 8, 10 by replacement with the intermediate pieces 9 to reduce a deleterious influence of Joule heat otherwise generated in the thermoelectric elements. Thus, Bijvoets does not consider mutual interference between first and second thermoelectric converter elements. Furthermore, when the intermediate pieces 9 are incorporated into the circuit of the device of Bijvoets, Joule heat is merely added in the intermediate connector piece 9, causing the efficiency of the device to be adversely affected.

Furthermore, Applicant respectfully submits that Bijvoets is based upon erroneous conclusions and principles. In col. 1, line 45, to col. 2, line 31, Bijvoets suggests that the intermediate pieces have a negligible resistance and generate hardly any Joule heat. This is

incorrect because the efficiency of the thermoelectric conversion circuit of Bijvoets would be remarkably reduced due to Joule heat loss in the intermediate pieces 9, which in turn would cause Joule heat loss in the whole thermoelectric conversion circuit of Bijvoets.

In col. 3, lines 7-18, Bijvoets states that thermoelectric effects are created in the bridges 5 and that there is substantially no enhancement or depletion processes at both ends of the intermediate pieces 9 because semiconducting material of the same conductivity type is present. One of ordinary skill in the art would understand that these statements are erroneous in view of the known Peltier effect, Seebeck effect, and Thomson effect. In col. 4, lines 16-19, Bijvoets states that intermediate pieces 9 will behave as P-type or N-type materials, depending on the conductivity type of semiconducting pieces 8, 10 at the ends of the intermediate pieces 9. This explanation can only be based on a misinterpretation of physical phenomena for a different effect. In col. 4, lines 24-31, Bijvoets states that the thickness of the semiconducting pieces 8, 10 is on the order of several micrometers and that these pieces are made of a common semiconductor material, such as BiTe, with the thickness being about 0.1% of a conventional length of an element half, which causes losses of Joule heat of the semiconductor material to be reduced by the same order of magnitude. One of ordinary skill in the art would also understand that this statement is based on a misinterpretation of physical phenomena.

For at least the reasons discussed above, Bijvoets does not anticipate claims 1-4 and 34. Reconsideration and withdrawal of this rejection is respectfully requested.

**Rejections Under 35 U.S.C. §103**

Claim 5 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of U.S. Patent 6,271,459 to Yoo (hereafter “Yoo”).

Claims 6 and 7 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of U.S. Patent 6,100,600 to Pflanz (hereafter “Pflanz”).

Claims 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, 23, and 24 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of U.S. Patent 5,987,891 to Kim *et al.* (hereafter “Kim”).

Claims 10, 13, 16, 19, 22, and 25 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of Yoo and Kim.

Claims 28, 29, 31 and 32 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of Kim and Pflanz.

Claims 30 and 33 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bijvoets in view of Yoo, Kim, and Pflanz.

Applicant respectfully traverses these rejections. Yoo, Pflanz, and Kim fail to remedy the deficiencies of Bijvoets discussed above. Therefore, the combinations of Bijvoets with Yoo, Pflanz, and/or Kim set forth by the Office above fail render claims 5-10, 14-16, 20-22, and 28-30 as unpatentable.

In view of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the outstanding rejections under §103.

#### **Provisional Obviousness-Type Double Patenting Rejections**

Claims 1-25 and 28-34 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as allegedly being unpatentable over claims 1-15 of co-pending Application No. 10/537,357.

Inasmuch as this is a *provisional* rejection, Applicant respectfully requests that the Office hold this rejection in abeyance while the prior art rejections are resolved. Applicant also reserves the right to take further action should the rejection become non-provisional.

#### **Conclusion**

Applicant submits that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.


The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing or a credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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Date \_\_\_\_\_

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